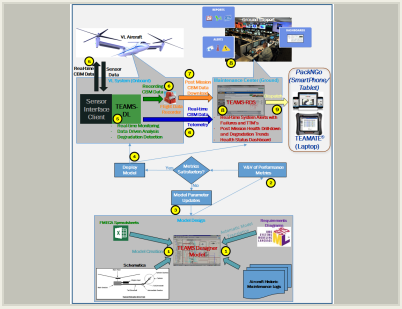
Predictive Condition-Based Maintenance for Vertical Lift Vehicles, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

NASA has invested significant effort in the past decade in developing and maturing technologies that enable efficient and effective use of Next-generation (NextGen) Vertical Lift (VL) systems for a broad class of missions and operations. One of the key barriers it faces to the widespread use of VL vehicles within the National Airspace is the cost of maintenance on the vehicles to keep them safe and reliable. Qualtech Systems, Inc (QSI) in collaboration with Lockheed Martin - Mission Systems and Training (LM-MST) seeks to address these maintenance challenges by fielding a predictive Condition Based Maintenance Plus (CBM+) solution leveraging a diagnostic reasoner TEAMS-RDS (Testability Engineering And Maintenance System Remote Diagnosis Server) and prognostic algorithms. CBM+ involves inferring, tracking and forecasting of system degradation based on state awareness acquired from monitored data through fault detection, isolation, identification, diagnosis and prognosis techniques and to proactively plan maintenance actions to improve system availability and safety. QSI-LM's CBM+ solution will furnish the ability to keep the vehicle health status continually ahead of an advancing failure accumulation through a predictive maintenance strategy geared towards replacement-while-in-operation before the ensuing failures render the VL vehicle inoperable. Diagnosis will focus on current health state identification through detection, isolation, root cause analysis and identification of faults that have already occurred, while prognosis will leverage the current health state identification and forecast performance degradation, incipient component failures and probability density (or moments) of remaining useful life (RUL) or Time to Maintenance (TTM) or Time to Failure (TTF). It is anticipated that the CBM+ solution will leverage the currently existing communication capabilities between the aircraft, the pilot and ground-support personnel in a seamless and automated manner.



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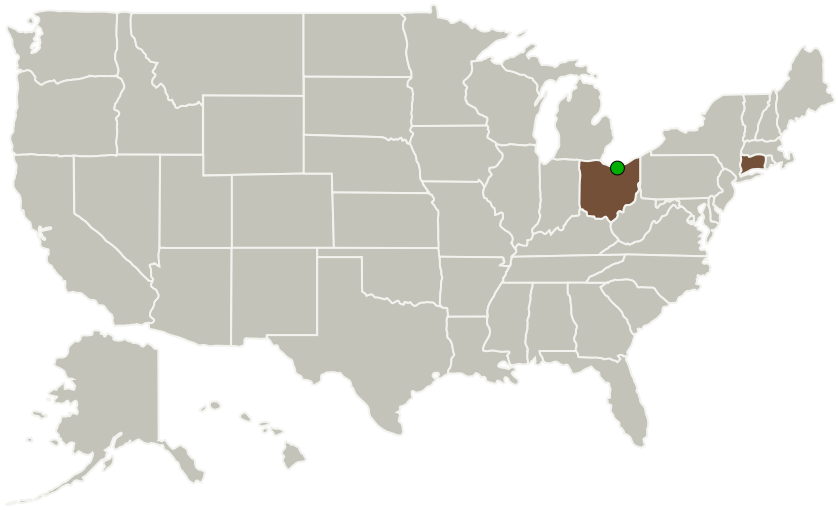
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Qualtech Systems, Inc.	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Rocky Hill, Connecticut
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Connecticut	Ohio

Project Transitions

June 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Qualtech Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

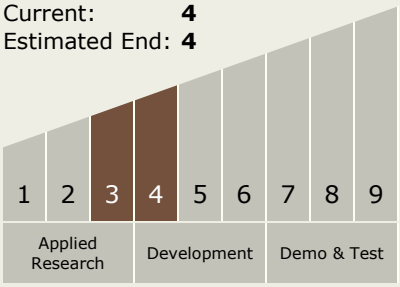
Carlos Torrez

Principal Investigator:

Sudipto Ghoshal

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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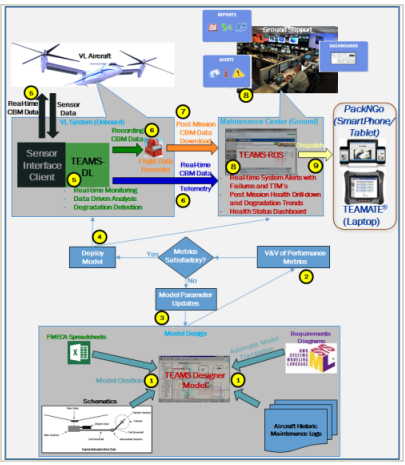
December 2016: Closed out

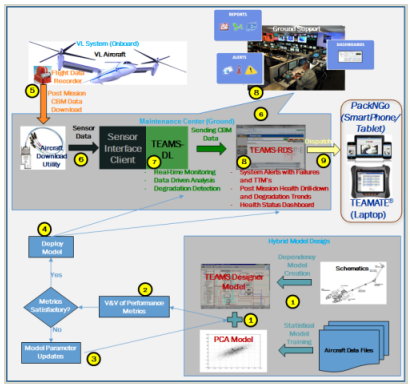
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139877)*

Images



Briefing Chart Image
Predictive Condition-Based Maintenance for Vertical Lift Vehicles, Phase I *(https://techport.nasa.gov/image/126127)*



Final Summary Chart Image
Predictive Condition-Based Maintenance for Vertical Lift Vehicles, Phase I Project Image *(https://techport.nasa.gov/image/126132)*

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System